

REMARKS

Claims 1-4 are presently pending in the captioned application with no claims being amended.

Applicant provide further argumentation that the presently claimed invention unexpectedly reduces the number of hot spots resulting in a more efficient production process.

Accordingly, Applicant respectfully requests the Examiner to consider the argumentation and allow all claims as presently pending.

**1. Rejection of Claim 1 under
35 U.S.C. § 112, 1st paragraph**

The Office Action rejects claim 1 under 35 U.S.C. § 112, 1st paragraph because the specification allegedly fails to reasonably enable all the catalysts known in the field of chemistry. The Office Action States:

The specification does not enable a person skilled in the art to which it pertains, or with which it is most nearly connected, to include all the catalysts unrelated to the invention commensurate in scope with these claims. Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without undue experimentation. Attention is directed to *In*

re *Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

- 1) the quantity of experimentation necessary.
- 2) the amount of direction or guidance provided,
- 3) the presence or absence of working examples,
- 4) the nature of the invention,
- 5) the state of the prior art,
- 6) the relative skill of those in the art,
- 7) the predictability of the art, and
- 8) the breath of the claims.

In the instant case, the claim encompasses a number of multi-combined catalysts. However, applicants' specification provide only 6 particular exemplified catalyst compounds shown in the specification (see pages 9-13). Furthermore, the catalyst compositions represent an unpredictable aspect in the art of organic chemistry. See *Exparte Sizto*, 9 USPQ2d 2081 (Bd. Of App. And Inter. March 1988). Thus, the specification herein has failed to provide sufficient working examples to support the use of numerous combinational catalysts. Therefore, an appropriate correction is required.

Applicant respectfully traverses the rejection because one of ordinary skill in the art would have been able to practice the presently claimed invention without undue experimentation. In particular, Referential Examples 1-6 along with the disclosure in the specification sufficiently enables one of ordinary skill in the art to make the plural catalysts of claim 1 as presently claimed.

Moreover, the unpredictability of catalyst compositions are rendered predictable in the present case by the precise and detailed description provided for the process of producing as well as the compositional make-up of the presently claimed plural catalysts.

In particular, the first paragraph of 35 U.S.C. § 112 requires that the "specification shall contain a written description of the invention" To satisfy the requirement, the specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. Vas-Cath, Inc. v. Mahurkar, 935 F.2d 1550, 1563, 19 USPQ2d 1111, 1116 (Fed. Cir. 1991). Moreover, a description as filed is presumed to be adequate, unless the examiner presents sufficient evidence or reasoning to rebut the presumption. See e.g., In re Marzocchi, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971).

The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description wherein the examiner has the initial burden of proving why a person skilled in the art would not recognize a description of the invention defined by the claims. See In re Wertheim, 541 F.2d at 263-64, 191 USPQ at 97; "Guidelines for the Examination of Patent Application Under the 35 U.S.C. 112, §1, "Written Description" Requirement" Federal

Register, Vol. 66, No. 4, (Friday, January 5, 2001).

Turning to the *prima facie* case, Applicant respectfully submits that the Office Action has failed to satisfy the burden insofar as the Office Action fails to provide a reasonable basis why a person skilled in the art would not be able to make the plural catalysts as claimed in view of the disclosure and Referential Examples 1-6. In particular, the unpredictable aspect of catalyst compositions within the art of organic chemistry is not applicable in the present situation because Applicant has sufficiently described the invention through the Referential Examples 1-6 and disclosure such that one of ordinary skill would have been reasonably enabled to make the presently claimed plural catalysts without undue experimentation.

Moreover, one of ordinary skill in the art would have reasonably concluded that Applicant had possession of the claimed plural catalysts because Applicant provides the process of making as well as provides an extremely detailed description of the catalysts. For example, Applicant states that the plural catalysts have the general formula (1) $\text{Mo}_a\text{W}_b\text{Bi}_c\text{Fe}_d\text{A}_e\text{B}_f\text{C}_g\text{D}_h\text{E}_i\text{O}_x$ wherein Mo is molybdenum; W is tungsten; Bi is bismuth; Fe is iron; A is at least an element selected from cobalt and nickel; B is at least an element selected from phosphorus, tellurium, arsenic, boron, antimony, tin, cerium, niobium, lead, chromium, manganese and zinc;

C is at least an element selected from alkali metal elements; D is at least an element selected from alkaline earth metal elements; E is at least an element selected from silicon, aluminum, titanium and zirconium; and O is oxygen; a, b, c, d, e, f, g, h, i and x denote the atomic numbers of Mo, W, Bi, Fe, A, B, C, D, E and O, respectively, and where a is 12, b is 0-5, c is 0.1-10, d is 0.1-10, e is 1-20, f is 0-5, g is 0.001-3, h is 0-3, i is 0-30, and x is a numerical value which is determined depending on the extent of oxidation of each of the elements.

Given such extreme detail as to the character and type of the plural catalysts of the present invention, it can hardly be said that the claimed plural catalysts rise to the level of unpredictability contemplated by Ex parte Sizto. 9 USPQ2d 2081 (Bd. Of App. And Inter. March 1988). One of ordinary skill in the art based on the amount of direction provided by specification as to the preparation of the plural catalysts along with the working examples (Referential Examples 1-16) and still further in view of the state of the art as well as predictability of catalysts in view of the detailed claim limitations would have clearly been able to make the invention without undue experimentation.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection to claim 1 under § 112, 1st paragraph.

2. Rejection of Claims 1-4
under 35 U.S.C. § 103(a)

The Official Action states that claims 1-4 are rejected under 35 U.S.C. § 103(a) as being unpatentable over WO 98/24746 ("Wada et al.") which is equivalent to U.S. 6,028,220 ("Wada et al."). The Office Action states:

Wada et al discloses a process for the preparation of acrolein and acrylic acid by carrying out the vapor phase oxidation of propylene with molecular oxygen or a gas containing molecular oxygen using a fixed bed multi-tubular reactor (see col. 1, lines 8-13). Furthermore, the reaction process for the production of acrolein and acrylic acid can be performed by introducing a mixture gas consisting of 1 to 10% by volume of propylene as the starting material (see col. 8, lines 26-29).

In the process, a plurality of oxidation catalysts having a composition of the following formula is employed: $\text{Mo}_a\text{Bi}_b\text{Ni}_c\text{Co}_d\text{Fe}_f\text{Y}_g\text{Z}_h\text{O}_x$ where Mo, Bi, Ni, Co, and Fe represent molybdenum, bismuth, nickel, cobalt and iron, respectively; Y is at least one element selected from the group of tin, zinc, tungsten, manganese, magnesium, antimony and titanium; Z is at least one element selected from the group of potassium, rubidium, thallium, and cesium; a, b, c, d, f, g, h, and x represent the number of atoms of molybdenum, bismuth, nickel, cobalt, iron, Y, Z, and oxygen; $a=12$, $b=0.1$ to 7, $c+d=0.5$ to 20, $f=0.5$ to 8, $g=0$ to 2, $h=0$ to 1 and x is determined by the oxidized condition of each element (see col. 4, lines 13-29) in U.S. 6,028,220.

Moreover, the plurality of catalysts having different occupying volumes (see col. 2, lines

45-47) is set-up so as to form a catalyst layer into two or three parts depending on calcinations temperature and time and the plurality of catalysts with an amount of at least 20% by weight based on the sum of the supported catalyst (see col. 4, lines 40-41) in each of a plurality of reactions zones is arranged in such an order that the activity increases toward the outlet from the inlet of the material in the axial direction of the tube (see col. 8, lines 47-54).

Furthermore, the Wada et al. indicates that a plurality of catalysts having different occupying volumes are packed in such a manner that the occupying volume becomes smaller toward its outlet side from the inlet side of the reaction tube (see col. 2, lines 45-59). In addition, the activities of a plurality of catalysts are controlled by changing composition of catalytically active components (kind and/or quantity of an alkali metal in particular) are packed in the reaction tube (see from col. 1, line 66 to col. 2, line 2). Also, the powder containing catalytically active components is subjected to preliminary calcinations at a temperature of from 300 to 500°C. (see col. 5, lines 40-42).

However, the instant invention differs from the reference in that the amount of the alkali metal element and different occupying volumes for plural catalysts in the range are specified; and the term "molded" catalysts are not disclosed.

Concerning the unspecified amount of the alkali metal element and the unspecified, differently occupying volumes, the reference does describe in a different terminology that the plurality of catalysts having different occupying volumes (see col. 2, lines 45-47) is set-up so as to form a catalyst layer into two or three parts depending on calcination temperature and time and the plurality of catalysts with an amount of at least 20% by

weight based on the size of the supported catalyst (see col. 4, lines 40-41) in each of a plurality of reaction zones is arranged in such an order that the activity increases toward the outlet from the inlet of the material in the axial direction of the tube (see col. 8, lines 47-54). In addition, the activities of a plurality of catalysts are controlled by changing composition of catalytically active components (kind and/or quantity of an alkali metal in particular) are packed in the reaction tube (see from col. 1, line 66 to col. 2, line 2).

With respect to the absence of the term "molded" catalysts, this is directly related to the optimization of using the catalysts in the process. Furthermore, the shape of the catalysts does not have any patentable weight over the prior art reference. Therefore, it would have been obvious to the skilled artisan in the art to have motivated to mold the Wada's et al. catalysts in a proper shape by routine experimentation in order to obtain an optimum level for the catalytic activity during the process.

Furthermore, the limitation of a process with respect to the amount of the alkali metal element and occupying volumes does not impact patentability to a process when such values are those which would be determined by one of ordinary skill in the art in achieving optimum operation and the process in the absence of an unexpected result. Occupying volume is well understood by those of ordinary skill in the art to be a result-effective variable, especially when attempting to control selectivity of a chemical process. Therefore, it would have been obvious to the skilled artisan in the art to have motivated to adjust the Wada's et al. amount of the alkali metal element and occupying volumes by routine experimentations in order to obtain the optimum ranges for the catalytic activity for the plurality of catalysts. This is because

the skilled artisan would expect to increase the catalytic activity for the plurality of catalysts by the manipulation of the amount of the alkali metal element and occupying volumes.

Applicant traverses the rejection because Wada et al. does not teach each and every claimed limitation of amended claim 1. In particular, Wada et al. fails to disclose a **molded** catalyst as well as the specifically claimed limitations regarding occupying volume, calcining temperature and type of alkali metal element. Even assuming *arguendo* that a *prima facie* case has been established, Applicant notes that the presently claimed limitations unexpectedly result in a reduction of hot spots and heat build-up associated with the hot spots.

As the Federal Circuit ruled, a *prima facie* case of obviousness must establish: (1) some suggestion or motivation to modify the references; (2) a reasonable expectation of success; and (3) that the prior art references teach or suggest all claim limitations. Amgen, Inc. v. Chugai Pharm. Co., 18 USPQ2d 1016, 1023 (Fed. Cir. 1991); In re Fine, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988); In re Wilson, 165 USPQ 494, 496 (C.C.P.A. 1970).

However, even if a *prima facie* case of obviousness has been established, secondary considerations such as commercial success, long felt but unsolved need, failure of others, and unexpected

results may nevertheless give rise to a patentable invention. Graham v. John Deere Co., 148 U.S.P.Q. 459 (1966). For example, evidence such as superiority in a property the compound shares with the prior art can rebut a *prima facie* case of obviousness. See In re Chupp, 816 F.2d 643, 646, 2 USPQ2d 1437, 1439 (Fed. Cir. 1987).

In the present application, amended claim 1 recites a process for producing acrolein and acrylic acid, comprising **molded** catalysts which are formed of complex oxides of the composition expressed by a general formula (1):



wherein the plural kinds of catalysts are different from each other in

(α) occupying volume, and

(β) calcining temperature and/or

(γ) kind and/or amount of the alkali metal element,

wherein the occupying volume (α) is prepared by varying the dimensions of the molded catalyst particles in a range of **3-15mm**,

the calcining temperature (β) is in a range of **300-650°C**,

the alkali metal element (γ) is prepared by varying the atomic number g in the general formula (I) within the range of **0.001-3**.

Wada et al., on the other hand, fails to teach each and every

claimed limitation. Wada et al. does not teach a unsupported, molded catalyst (α) occupying volume wherein the occupying volume (α) is prepared by varying the dimensions of the molded catalyst particles in a range of 3-15mm or a (β) calcining temperature wherein the calcining temperature (β) is in a range of 300-650°C and/or (γ) a alkali metal element prepared by varying the atomic number g in the general formula (I) within the range of 0.001-3.

Wada et al. also fails to teach the presently claimed limitation that the plural catalysts are molded. Instead, Wada et al. requires that the catalytically active components be supported on a carrier and then mixed with a molding additive. See Wada et al. at col. 5, line 59-60. Wada et al. specifically forecloses any unsupported catalysts by stating that the oxidation catalyst is "to be supported on a carrier". See id. at col. 5, line 4. This can also be shown mathematically by the teachings of Wada et al. In particular, Wada et al. specifically states at col. 6, lines 56-59, that

The ratio of the catalytically active component to the whole of the calcined catalyst may be different with much extent of **5 to 80%** by weight and the ratio is preferable **10 to 60%** by weight and more preferable **20 to 55%** by weight.

Wada et al. continues at col. 7, lines 9-12 that the supporting amount of catalytically active components is calculated in

accordance with the formula:

Weight of catalytically active components
[Weight of catalytically active components
+ Weight of carrier
+ Weight of strength improving agent after calcination
(optional component)]

But because a molded catalyst has a zero (0) Weight of carrier amount and has a zero (0) Weight of strength improving agent amount, the supporting amount according to the weight formula of Wada et al. would be 100% for a molded catalysts. This is clearly outside the teachings of Wada et al., which specifically recite that the range of the catalytically active component to the whole of the calcined catalyst is confined to a range of **5 to 80%** by weight. See Wada et al. at col. 6, lines 56-59. Therefore, one of ordinary skill in the art who intended to prepare a catalyst from the teachings of Wada et al. would only try a supporting rate within the above-mentioned range of at most 80% by weight and would not have been provided any motivation or suggestion to make a molded catalyst with a zero (0) Weight of carrier amount and a zero (0) Weight of strength improving agent amount.

Wada et al. further teaches that the size of the supported catalyst is dependent on the size of the carrier, the supporting amount and other carrier-dependent factors. See id. at col. 7, line 53-55. Even claim 1 of Wada et al. requires in paragraph (a)

that the plurality of catalysts be supported on a carrier. Clearly, a carrier is critical to the catalysts of Wada et al.

Although the Office Action maintains that occupying volumes is a results-effective variable, the presently claimed limitations unexpectedly result in a reduction of hot spots, heat build-up associated with the hot spots. This advantageously allows an increase in the concentration of polypropylene used during the manufacturing process. One of ordinary skill in the art would not have known that the synergistic combination of occupying volume, kind and/or amount of the alkali metal(s) and calcining temperature for a molded and unsupported catalyst would unexpectedly reduce hot spots and heat build-up associated with the hot spots. In other words, Wada et al. fails to teach that optimization of occupying volumes, alkali metals and calcining temperature would have given rise to a remarkably reduced formation of heat spots. See In re Antoine, 195 UPSQ 6 (C.C.P.A. 1977).

Wada et al., on the other hand, takes a completely different approach to avoiding hot spots by filling plural reaction zones in the reactor with plural kinds of catalysts having different activity which are prepared by changing calcining temperature and the supporting rate of supported catalyst. In particular, Wada et al. teaches (1) diluting catalysts at a hotspot with an inert substance (column 1, lines 54 to 57), (2) making a catalyst in a

tubular shape (column 1, lines 57 to 60), (3) filling plural reaction zones with plural kinds of catalysts having different activity which have been prepared by the change of kind and/or quantity of alkali metal (col. 1, line 66 to col. 2, line 2) and (4) filling plural reaction zones with plural kinds of catalysts having different occupying volume (col. 2, lines 45-49).

In contrast, the presently claimed limitations relate to a synergistic combination of (α) "the change of occupying volume", (β) "the change of calcining temperature" and/or (γ) "the change of kind and/or quantity of alkali metal", which unexpectedly result in reduction of hot spots and therefore improved acrolein and acrylic acid production.

Clearly, a *prima facie* case of obviousness has not been established because each and every claimed limitation has not been taught by the cited reference. Even if a *prima facie* case of obviousness exists, the unexpectedly improved result of a reduction of hot spots imparts patentability onto the presently pending claims.

Accordingly, Applicant respectfully submits that the presently claimed invention is not obvious over Wada et al. and respectfully request the Examiner to reconsider and withdraw the § 103(a) rejection of claims 1-4.


CONCLUSION

In light of the foregoing, Applicant submits that the application is now in condition for allowance. The Examiner is therefore respectfully requested to reconsider and withdraw the rejection of the pending claims and allow the pending claims. Favorable action with an early allowance of the claims pending is earnestly solicited.

Respectfully submitted,

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